How Does the Thermal Conductivity of Liquids Affect Heat Absorption in Photovoltaic Troughs?

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The purpose of this research was to determine which fluids would make photovoltaic troughs operate at maximum efficiency. The hypothesis states: if the thermal conductivity of a liquid increases, then the rate at which the liquid will absorb heat will increase. To investigate which fluid – propylene glycol, ethylene glycol, or glycerin – would absorb heat fastest, a photovoltaic trough was designed and built to heat the liquids. The trough was set up at the same time each sunny day in order to heat the liquids in a realistic system. The experiment consisted of three trials for each liquid tested. 80 mL of each liquid was poured into the pipe of the trough and allowed to heat for ten minutes. The temperature was recorded via a temperature probe to collect accurate data. The data supported my hypothesis. In order of increasing thermal conductivity, the average rate of temperature increase of each liquid was; propylene glycol at 12.4 °C/minute, ethylene glycol at 14.0 °C/minute, and glycerin at 15.0 °C/minute. This investigation determined that liquids with higher thermal conductivities, such as glycerin, absorb heat faster than those with lower thermal conductivities, thus showing the liquids will be more effective at increasing the energy output of photovoltaic troughs. Increasing the efficiency of photovoltaic troughs through the use of glycerin over other currently used fluids, such as ethylene glycol, will help cut down on cost, reduce the toxicity, and increase the potential of future nanofluids in these clean-energy systems.